CJuska_Job_1_of_1

Printed by HPS Server
for

EAST

Printer: cp3_11c17_gbflptr
Date: 04/18/03
Time: 14:24:18

Document Listing

Document	Selected Pages	Page Range	Copies
WO000198575	36	1 - 36	1
Total (1)	36	-	-

HPS Trailer Page
for
EAST

UserID: CJuska_Job_1_of_1
Printer: cp3_11c17_gbflptr

Summary

Document	Pages	Printed	Missed	Copies
WO000198575	36	36	0	1
Total (1)	36	36	0	-

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) W rld Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2001 (27.12.2001)

PCT

(10) International Publication Number
WO 01/98575 A1

(51) International Patent Classification[7]: D05C 17/02, B32B 7/04, 7/12, 27/12, 27/20, 31/04, 31/06, 31/08, 31/12, 31/20, 31/26

(21) International Application Number: PCT/US01/20150

(22) International Filing Date: 22 June 2001 (22.06.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/599,003 22 June 2000 (22.06.2000) US

(71) Applicants and
(72) Inventors: ELLIS, Larry, E. [US/US]; 519 Wisley Way, Ringgold, GA 30736 (US). LEWALLYN, Michael, A. [US/US]; 9321 Highway 52, Chatsworth, GA 30705 (US).

(74) Agents: FROST, Roger, T. et al.; Kilpatrick Stockton LLP, Suite 2800, 1100 Peachtree Street, Atlanta, GA 30309-4530 (US).

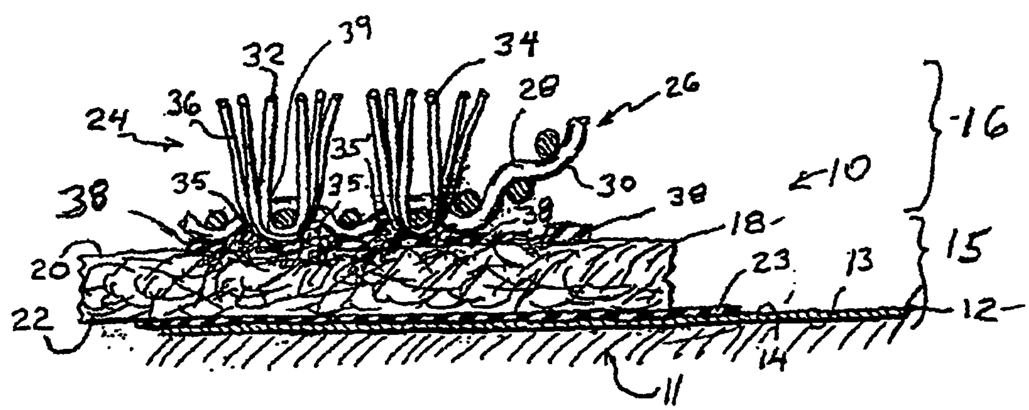
(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LIQUID-IMPERMEABLE, VAPOR-PERMEABLE, INTEGRAL FLOOR COVERING AND PROCESS FOR THE MANUFACTURE THEREOF



(57) Abstract: A liquid-impermeable, vapor-permeable floor covering, such as a carpet or rug, is provided. In one embodiment of the floor covering (10), it has an upper or top tufted carpeting layer (16) that includes a primary substrate (26) and tufts (32, 34) of yarn (36) extending above the primary substrate (26). A composite secondary backing (15) is located below the primary substrate (26) and is bonded to the carpeting layer (16) by adhesive layer (38). A breathable polymeric film (12) which is liquid-impermeable and vapor-permeable is located below and bonded to a secondary substrate (18) by adhesive layer (23). A method of manufacturing the floor covering (10) includes adhesively bonding an upper surface (14) of a microporous, liquid impermeable, vapor permeable film (12) to a lower surface (22) of a secondary substrate (18), thereby forming a composite secondary backing (15); and then bonding an upper surface (20) of the composite secondary backing (15) to the lower surface (30) of a primary substrate (26) with a hot melt adhesive (38).

WO 01/98575 A1

LIQUID-IMPERMEABLE, VAPOR-PERMEABLE, INTEGRAL FLOOR COVERING AND PROCESS FOR THE MANUFACTURE THEREOF

FIELD OF THE INVENTION

This invention relates in general to floor coverings and especially those having tufts of yarn, such as rugs and wall-to-wall carpets for domestic and industrial use.

BACKGROUND

Prior floor coverings such as rugs and wall-to-wall carpets for domestic and industrial use suffer from a number of disadvantages. For example the current, predominant approach regarding backing material and its application is more than fifty years old and is not only outdated because of environmental issues, but also because new technology in both raw materials and equipment offer major opportunities in the areas of cost reduction, energy conservation and improved product performance. The current manufacturing techniques use a conventional latex as the principle adhesive (other adhesive materials suspended in water such as polyurethane are also used) which results in a product that cannot disintegrate in land fills, is banned from some land fills and thus is creating an environmental problem, and is very expensive to manufacture because of all the natural gas that must be used to

heat the carpet components during manufacture so as to drive off the water and dry the components and so as to set the latex.

A major disadvantage is that such prior floor coverings are permeable to liquids such as water. When liquids are spilled they frequently travel through the floor covering and damage the underlying floor. Attempts have been made to make these floor coverings impermeable to water, but this has led to only limited success and has caused other problems.

A number of United States patents discuss the problems of floor coverings and each provides its own particular attempt to solve the discussed problems. These patents, which are incorporated herein by reference in their entirety, include the following.

The use of cellulosic paper as described in Sands, U.S. Patent No. 3,264,167, results in a floor covering wherein the paper disintegrates upon contact with water.

West et al., U.S. Patent No. 3,387,989, employs a hydrophobic residium and a microporous intermediate layer.

Ucci U.S. Patent No. 4,579,762 employs aromatic sulfonates as a treatment.

Vinod, U.S. Patent No. 5,348,785, employs a secondary backing which is substantially impervious to solutions.

Heim, U.S. Patent No. 5,558,916, discloses a secondary backing which is substantially impervious to liquids.

Irwin, U.S. Patent No. 5,612,113, employs a thin film of liquid impervious thermoplastic material.

Murphy et al., U.S. Patent No. 5,763,040, teaches the application of a water permeable latex as well as a non-latex fabric which is substantially impervious to liquids.

Wyman, U.S. Patent No. 5,902,658, discloses a floor covering together with a substrate which is impervious to liquid.

Krotine, U.S. Patent No. 5,962,350, discloses a multi layer floor covering one layer of which is capable of "holding liquid".

More recently E. I. du Pont de Nemours and Company of Wilmington, Delaware, USA (duPont) developed a breathable moisture protective barrier product that has the trademark SPILLNET. This product is a very lightweight, nonwoven sheet bonded to a breathable film and is sold in rolls seventy-four inches wide. When installed properly it catches any liquid spills that have soaked through the carpet backing and keeps the liquid above the cushion. It also promotes moisture vapor transfer. The SPILLNET product is designed to be installed by first laying it on top of padding that has been previously installed. It cannot be adhered directly to a floor, such as is used for commercial carpet that is glued directly to a floor; and cannot be glued with an

environmentally friendly hot melt adhesive because it is too thin and will be damaged. The product has other disadvantages, including a low relative dimensional stability, has a tendency to wrinkle, and is susceptible to being damaged during the carpet seaming process from an installer's knife, by walking on it, or scuffing it when the carpet is drug across it during carpet installation. It is then cut and tacked down. Then the carpet is laid loosely on top of the SPILLNET product, cut and tacked down or otherwise secured using conventional techniques. Thus, three separate time consuming steps are required to apply the SPILLNET product. Because the narrow width of this product is far less than the width of the normal room, the product must be overlapped. In the vicinity where it is overlapped, there is provided a path by which liquids can travel around the edge of a given sheet. This results in undesirable contact of the liquid with the underlying subfloor. Installation of this product is expensive and time consuming.

There is thus a strongly felt need for a carpet that can be manufactured at a lower cost; which can be economically recycled or discarded in conventional land fills; is easy to put down; can be either glued or tacked to an under flooring; and can prevent water from penetrating to the under flooring on the one hand, yet also permit water vapor from the under flooring to pass upwardly through

the carpet so as to minimize bacteria, mold and mildew growth beneath the carpet.

SUMMARY OF THE INVENTION

Accordingly it is an object of the present invention to provide an improved floor covering substantially free of one or more of the disadvantages of prior floor coverings.

Another object is to provide an improved floor covering which is easy and inexpensive to install, and which is a non-latex, thermoplastic floor covering that is fully recyclable. Such floor covering has improved properties by being waterproof, breathable, and improved physical performance characteristics. When such floor covering is a carpet or rug, it is an object to provide a much improved backing composite and attendant laminated backing that results in an improved carpet or rug.

Still another object is to provide an improved, less expensive process for producing an improved floor covering, the process having a reduced production and operator personnel requirement, a lower energy requirement, a higher production speed, and a lower requirement for floor space for the production equipment, which equipment is less expensive.

With the present invention, in one embodiment, an integral, laminated floor covering, such as a carpet, includes a microporous

film barrier in which liquids can not penetrate, yet through which moisture vapors can pass thereby preventing the accumulation of liquid next to the floor and the subsequent accumulation and growth of bacteria, mildew, and mold with their attendant odors and health problems. Such a carpet is also easier to install and has a reduced damage to the building structure due to a softer, more flexible and non-abrasive nature of the composite backing.

A floor covering and the method of the making thereof according to the present invention has at least the following advantages. There is a dramatic improvement in cleanability, improved aesthetics and sanitation; and there is a liquid barrier combined with a breathable floor covering. When the floor covering is a carpet or rug, there is an improved floor covering fabric performance that includes a better yarn fiberlock, bundlewrap and greater delaminating strength. Such a product is fully recyclable, has a reduced total product weight per square yard, and in one embodiment is a totally thermoplastic product that can be very economically produced with a reduced adhesive material requirement, a reduced amount of energy needed to manufacture it, and a reduced production equipment downtime for maintenance and clean-up. Such a product in a preferred embodiment also results in an improved storage and inventory management in the production facilities due to the use of a thermoplastic adhesive that can be reactivated,

thereby permitting partial manufacture and a later completion. Such a product will also substantially avoid the necessity for being land filled due to the greatly improved recyclability of the new thermoplastic backing composite.

According to one aspect or the present invention there is provided a liquid-impermeable, vapor-permeable floor covering which in a specific embodiment is a carpet comprising:

A. a lower layer which includes:

1. a breathable polymeric film which is liquid-impermeable and vapor-permeable, the breathable polymeric film having an upper surface and a lower surface, and

2. a secondary substrate having an upper surface and a lower surface; wherein the lower surface of the secondary substrate is bonded to the upper surface of the breathable polymeric film; and

B. an upper layer comprising:

1. a primary substrate or primary substrate having an upper surface and a lower surface; and

2. an outer covering such as tufts of yarn extending away from the upper surface of the primary substrate;

wherein the lower surface of the primary substrate is bonded to the upper surface of the secondary substrate.

According to another aspect of the present invention there is provided a process for producing the improved floor covering by the steps of:

A. adhesively bonding an upper surface of a microporous, liquid impermeable, vapor permeable film to a lower surface of a secondary substrate; and then

B. adhesively bonding the upper surface of the secondary substrate to the lower surface of a primary substrate.

Other objectives, features and advantages will be set forth in the following detailed description of the preferred embodiments of the invention or will be apparent to those skilled in the art

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the drawings wherein:

FIG. 1 is a cross sectional schematic representation of one embodiment of the floor covering of the present invention.

FIG. 2 is a cross sectional schematic representation of the floor covering of FIG. 1 showing how the floor covering is both liquid-impermeable and vapor-permeable.

FIG. 3 is a schematic perspective representation of a portion of a non woven fibrous secondary backing enlarged approximately 300 times actual size.

FIG. 4 is a cross sectional schematic representation of equipment used to bond a film to the secondary backing of FIG. 3 according to one embodiment of the invention.

FIGs. 5, 6, and 7 are cross sectional schematic representations of alternative equipment for producing a composite material useful to produce the floor covering of the present invention.

FIG. 8 is a plan view enlarged approximately 100 times actual size of a special film showing particularly the structure thereof, and useful as part of the floor covering of the present invention.

FIG. 9 is a plan view enlarged approximately 500 times actual size of the special film of FIG. 8, showing the microscopic structure thereof.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings in general in which like numerals are used to designate like elements throughout the several views, and in particular referring to FIG. 1, there is shown a liquid-impermeable, vapor-permeable floor covering 10 of the

present invention that has been laid on an under flooring 11. Floor covering 10 is preferably a carpet or rug having a top made of pile-carpet tufts, the tufts made from any conventional carpet fibers such as nylon, polypropylene, polyesters and wool. In carpeting the tufts can be of plied, cut strands of fiber yarns commonly referred to as "cut pile" (fabrics) or plied, uncut fiber yarns commonly referred to as "loop pile" (fabrics). Combinations of these fabric construction types are also produced.

However, any floor covering that can embody the concepts of the present invention are included, such as possible future floor coverings having an upper porous laminate instead of tufts. For the purposes of the description of the present invention, floor covering 10 will be described as a carpet. Under flooring 11 is conventional and includes both a finished floor and a sub flooring. For example flooring 11 can be concrete, ceramic tile, planks, particle board, plywood and tongue and groove hardwood flooring. Flooring 11 is depicted without any top covering, but it could have a plastic tile or solid sheet linoleum-type covering.

Floor covering 10 is comprised of a lower composite secondary substrate or layer 15 and an upper substrate or layer 16. Lower layer 15 is comprised of a breathable polymeric film 12 which is liquid-impermeable and vapor-permeable. Film 12 has a lower surface 13 and an upper surface 14. Lower layer 15 is also

comprised of a resilient, secondary substrate 18 having an upper surface 20 and a lower surface 22. In a currently preferred embodiment of the present invention secondary substrate 18 is non-woven. Lower surface 22 of secondary substrate 18 is bonded to upper surface 14 of breathable polymeric film 12 with an adhesive 23. Adhesive 23 is preferably a hot melt type of adhesive that is sprayed or otherwise applied in a pattern that partially penetrates lower surface 22 of secondary substrate 18 and that creates a lot of voids or spaces by using a process conventionally called fiberization.

Upper layer 16 as depicted in FIG. 1 is a tufted carpeting 24 comprising a primary substrate 26 having an upper surface 28 and a lower surface 30. Lower surface 30 of primary substrate 26 is bonded by means of an adhesive 38 to upper surface 20 of secondary substrate 18 as described hereinbelow. For now, it is simply noted that adhesive 38 is selectively located only at the lower loops of yarn 36. In a preferred embodiment adhesive 38 is a low viscosity adhesive. The threads of primary substrate 26 are depicted in Fig. 1 as being round, but they are usually flat and are woven together in a flat weave to make primary substrate 26.

Carpeting 24 also has tufts such as tufts 32 and 34 of a yarn 36 which extend away from primary substrate upper surface 28. Tufts 32 and 34 of yarn 36 extend orthogonally away from upper

surface 28 of primary substrate 26, passing through primary substrate 26 and forming an uneven lower surface 30 on the lower side of primary substrate 26 with voids 35 and 35' between successive tufts 32 and 34; and adjacent parallel rows of said tufts. Thus, fiber yarn bundles 39 of the lower loops of yarn 36 are created below lower surface 30 as shown in FIG. 1. Adhesive 38 penetrates and encapsulates fiber yarn bundles (backstitches) 39. Such penetration and encapsulation provide important fiberlock and bundlewrap properties which ensure continued integrity and stability of layer 16. Adhesive 38 bonds fiber yarn bundles 39 to upper surface 20 of secondary substrate 18 and the soft material of secondary substrate 18 fills voids 35 and 35' between strands of woven, primary substrate 26.

It will be understood that FIG. 1 is a schematic. In FIG. 1 part of primary substrate 26 is shown separated from adhesive 38, whereas in an actual embodiment primary substrate 26 is not separated but rather is bonded to carpeting 24 as described hereinbelow.

FIG. 2 illustrates some advantages of the present invention. Floor covering 10 is supported on a floor 40 comprised in part of a poured concrete slab 42 and in part of sub-flooring in the form of a plurality of tongue and grooved planks 44 and 46. Water in the form of droplets, such as droplets 48 and 50 purposefully or

accidentally spilled from any source such as a bucket 52, wet carpeting 24 and the composite secondary substrate or layer 15, as shown in Fig. 1, but cannot pass through film 12. In this manner neither slab 42 nor planks 44 and 46 can become wet. The water will, under normal living conditions, soon evaporate. Normal living conditions are those generally maintained in spaces occupied by humans, namely atmospheric pressure and an ambient temperature of from about 10°C to about 30°C and preferably from about 15°C to about 25°C; with relative humidity of from about 10 percent to about 90 percent and preferably from about 30 percent to about 70 percent.

FIG. 2 shows an additional advantage of the present invention. Sometimes floor 40, such as slab 42, becomes damp. This can occur if slab 42 is poured directly on the ground and moisture condenses out of the ambient air or passes through the concrete. While liquid water in slab 42 does not pass through breathable film 12, water vapor does pass through as shown by arrows 54 and 56. By permitting the water vapor an exit through the carpet, accumulation of moisture is prevented and in this manner there is no growth of fungi, algae, mildew, bacteria or other unwanted organisms.

FIG. 3 shows, approximately 300 times actual size, a portion of a secondary backing 18' useful in the present invention. Secondary backing 18' includes bicomponent fibers such as fibers

58, 59 and 60. Fiber 58 is representative. It has a core 62 of a high melt polymer and a coating 64 of a low melt polymer. When secondary backing 18' is heated to a temperature above the melting point of coating 64 but below the melting point of core 62, portions of coating 64 melt and bond fibers 58, 59 and 60 at their points of contact. As explained more completely below, film 12 can be bonded to secondary backing 18' in a similar manner.

FIG. 4 shows the equipment by which film 12 can be bonded to secondary backing 18'. Film 12 is fed from a source (not shown) to the nip between an idler roll 66 and a heated drum 68 which rotates in the direction of arrows 70, 71 and 72. Secondary backing 18' is also fed from a source (not shown) to the same nip between roll 66 and drum 68.

Drum 68 is heated by means (not shown, but which could include steam) to a temperature above the melting point of coating 64 of fibers 58, 59 and 60 but below the melting point of core 62 of fibers 58, 59 and 60. In this manner coating 64 melts and bonds fibers 58, 59 and 60 together and bonds fibers 58, 59 and 60 to film 12 in those locations where fibers 58, 59 and 60 contact film 12.

The result is a composite secondary backing 74 that becomes a lower layer, such as layer 15 in FIG. 1, and comprises secondary backing 18' having an upper surface 20 and a lower surface 22.

However, it will be understood that as shown in Fig. 4 lower surface 22 is above upper surface 20 and vice versa. This is because upper and lower surfaces 20 and 22 are named with respect to their orientation in FIG.2 whereby floor covering 10 of the present invention is placed on a floor 40. In other words composite secondary backing 74 is manufactured upside down in FIG. 4.

In composite secondary backing 74 lower surface 22 of secondary substrate 18' is bonded to upper surface 14 of breathable polymeric film 12 by melted and refrozen portions of the low-melt polymer of coating 64 of bicomponent fibers 58, 59 and 60.

FIG. 5 shows the equipment of an alternative method for producing a composite secondary backing 74' useful to produce floor covering 10 of the present invention. Hot melt adhesive 76 is applied to upper surface 14 of film 12. Immediately thereafter and before the adhesive has time to cool, secondary substrate 18 is caused to contact adhesive 76 thus bonding upper surface 14 of film 12 to lower surface 22 of secondary substrate 18. The resultant product is composite secondary backing 74'.

FIG. 6 shows yet another alternative method, and probably the most economical method once the equipment is set up and aligned, for producing a composite secondary backing 74'' useful to produce floor covering 10 of the present invention. Spinnerettes 78, 79

and 80, which are capable of producing meltblown fibers, directly extrude fibers 82 onto film 12. Fibers 82 can be for example polypropylene or polyethylene and are applied across the full width so as to create a sparsely assembled mat. Film 12 and fibers 82 pass between the nip of heated calendar rolls 84 and 86. The nip between calendar rolls 84 and 86 is adjustable in order to determine the thickness of the final product, a composite secondary backing 74''. This hot pressing process applied directly to film 12 also eliminates the need of an additional adhesive product.

FIG. 7 shows still another alternative method for producing a composite secondary backing 74''' useful to produce floor covering 10 the present invention. Secondary substrate 18 is positioned with its lower surface 22 facing upwards. Film 12 is created in situ by forcing a thermoplastic composition (not shown) through a slot 88 in an extruder 90. The slot is about 2 to 3 thousandths of an inch wide and the thermoplastic composition is under very high pressure.

FIG. 8 shows film 12 as comprising a thermoplastic polymer sheet 92 having embedded therein particles 94 and 96 of a filler. Filler particles 94 and 96 in one embodiment can be calcium carbonate and have a size in the order of microns, whereas film 12 has a size in the order of mils. Film 12 is made microporous by stretching it in a two step process in which a lateral stretching

is done by passing film 12 through the nip of two radially slotted, mating rollers, and a linear stretching is done by passing film 12 through

the nip of two fluted rollers in which the flutes traverse the length of the roller. The two sets of rollers cause microporous stress cracks around the solid particles in the film. A second method of making film 12 microporous is to fill the substrate with a soluble solid (e.g. salt particles) and then melting the particles with solvent. As a result, a large plurality of micro size holes are created through film 12 which makes film 12 vapor-permeable, but liquid-impermeable.

FIG. 9 shows film 12 with embedded particle 94. Around particle 94 are a number of stress cracks, such as stress cracks 98 and 99. Although cracks 98 and 99 go entirely through film 12 from upper surface 20 to lower surface 13 shown in Fig. 1, they are so small that they do not pass liquid water. Stress cracks 98 and 99 do, however, pass water vapor. Because stress cracks 98 and 99 are short they do not destroy the structural integrity of film 12.

The thickness of film 12 can vary greatly as long as it remains both liquid-impermeable and vapor-permeable. Generally film 12 has a thickness of from about 0.1 to 20 mils, preferably from 1 to 8 mils and ideally from 1 to 4 mils.

Particles 94, which are inserted into film 12 can be any of a wide variety of particles that can be used for making the micro pores through film 12. In one method of making the micro pores, the particles are of water insoluble inorganic materials examples of which include among others silica, titanium dioxide and calcium carbonate. Calcium carbonate is presently preferred because of cost and availability. However, sodium chloride or other water soluble crystal type particles can be used and the micro pores are made when the particles are dissolved out.

The particle sizes can wary widely but the particles generally have a diameter from about 5 microns to about 50 microns. Because 25 microns equal one mil, this means that the size of particles 94 are usually smaller than the thickness of film 12.

Core 62 of bicomponent fibers 58, 59 and 60 can be any of a wide variety of known polymers but are preferably those selected from the group consisting of poly(ethylene terephthalate), polypropylene, nylon and polyester.

Coating 64 of bicomponent fibers 58, 59 and 60 can be any of a wide variety of known low melt thermoplastic polymers but are preferably those selected from the group consisting of polyethylene and polypropylene.

The high melt fiber generally has a melting point at least 10°C and preferably at least 40°C greater than the melting point of low melt coating 64.

Any previously known primary substrate can be employed in the present invention. Primary substrate 26 can comprise a single woven or non woven sheet or can comprise a laminate of a plurality of sheets. Usually, primary substrate 26 is made of jute or a variety of woven or nonwoven commercial products commonly known as synthetic primary carpet backings.

The tufts of the carpet yarn can be monofilament or can be made of yarn from any natural or synthetic fiber heretofore employed to make carpets. Examples of natural fibers include those of cotton, wool and linen. Examples of synthetic fibers include those of poly(ethylene terephthalate), polypropylene, acrylic and nylon.

The secondary substrate can be made of any fibers employed to make the carpet as well as jute, hair and kenaf.

Although the invention has been described in considerable detail with reference to certain preferred embodiments thereof, it will be understood that those skilled in the art can make variations without departing from the scope of the invention as described above and as claimed below.

We claim:

CLAIMS

1. A liquid-impermeable, vapor-permeable floor covering comprising:

A. a lower layer composite secondary backing comprised of:

1. a breathable polymeric film which is liquid-impermeable and vapor-permeable, said breathable polymeric film having an upper surface and a lower surface, and

2. a secondary substrate having an upper surface and a lower surface, said lower surface of said secondary substrate being bonded to said upper surface of said breathable polymeric film; and

B. an upper layer comprised of:

1. a primary substrate having an upper surface and a lower surface; and

2. an outer covering above said primary substrate and having an upper surface and a lower surface, said outer covering being attached to said primary substrate;

C. a bonding connecting said lower surface of said primary substrate to said upper surface of said secondary substrate.

2. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 wherein said outer covering comprises tufts of

yarn extending away from said upper surface of said primary substrate.

3. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 2 wherein said tufts of yarn have bottom loops extending below said primary substrate.

4. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 3 wherein said bottom loops of said yarn are bonded to said upper surface of said secondary substrate.

5. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 wherein said polymeric film has a thickness of between about 0.001 and about 0.003 mils, and has stress cracks that pass through said film having a size such that water-vapor can pass therethrough, but liquid water can not pass therethrough.

6. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 5 wherein said film has micro particles embedded therein.

7. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 wherein said secondary substrate is of a non-woven fabric made of a thermoplastic polymer.

8. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 7 wherein said secondary substrate is comprised of intersecting bi-component fibers wherein each fiber has a core of a high melt thermoplastic polymer and a surrounding covering of a low melt thermoplastic polymer wherein said high melt fiber cores are bound to one another at their intersections by a melted and refrozen portion of said low melt thermoplastic polymer covering.

9. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 wherein said primary substrate is comprised of a plurality of threads woven together.

10. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 and further comprising a hot melt adhesive that bonds said lower surface of said primary substrate to said upper surface of said secondary substrate.

11. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 1 and further comprising an adhesive that penetrates and encapsulates at least a portion of a plurality of fiber yarn bundles comprising backstitches on said lower surface of said primary substrate and bonds said backstitches to said upper surface of said secondary substrate.

12. The liquid-impermeable, vapor-permeable floor covering as claimed in Claim 11 wherein said adhesive is a low viscosity hot melt adhesive.

13. A liquid-impermeable, vapor-permeable floor covering comprising:

A. a breathable polymeric film which is liquid-impermeable and vapor-permeable, said breathable polymeric film having an upper surface and a lower surface;

wherein said film has a thickness of between about 0.001 and about 0.003 mils;

wherein said film has stress cracks that pass through said film but do not destroy a structural integrity of said film;

wherein said stress cracks of said film pass water-vapor through said film but do not pass liquid water through said film;

wherein, embedded within said film are particles of calcium carbonate having a diameter equal to about one half a thickness of said film to about three times the thickness of said film;

B. a secondary substrate having an upper surface and a lower surface;

wherein the lower surface of the secondary substrate is bonded with an adhesive to the upper surface of said breathable polymeric film;

wherein said secondary substrate comprises a plurality of bi-component fibers;

wherein each bi-component fiber has a core of high melt thermoplastic polymer selected from the group consisting of poly(ethylene terephthalate), polypropylene, and nylon;

wherein the core of the bi-component fiber is surrounded by a low melt thermoplastic polymer selected from the group consisting of polyethylene and propylene;

wherein the high melt thermoplastic polymer has a higher melting point than the melting point of the low melt thermoplastic polymer;

wherein the bi-component fibers are bound to one another at their intersections by melted and refrozen portions of the low melt thermoplastic polymer; and

C. tufted carpeting comprising:

1. a primary substrate having an upper surface and a lower surface; and

2. tufts of yarn extending orthogonally away from the upper surface of the primary substrate, passing through the primary substrate and forming an uneven surface on the lower side of the primary substrate with voids between adjacent tufts of yarn;

wherein the lower surface of the primary substrate is bonded with an adhesive to the upper surface of the secondary substrate.

14. A process for producing a liquid-impermeable, vapor-permeable floor covering having a breathable polymeric film which is liquid-impermeable and vapor-permeable, said breathable polymeric film having an upper surface and a lower surface; a secondary substrate having an upper surface and a lower surface, wherein the lower surface of the secondary substrate is bonded to the upper surface of the breathable polymeric film; and a tufted carpeting comprising a primary substrate having an upper surface and a lower surface, and tufts of yarn extending away from the upper surface of the primary substrate, and wherein the lower surface of the primary substrate is bonded to the upper surface of the secondary substrate;

said process comprising, in sequence, the steps of:

I. adhesively bonding the upper surface of the film to the lower surface of the secondary substrate; and then

II. adhesively bonding the upper surface of the secondary substrate to the lower surface of the primary substrate.

15. A process for producing a liquid-impermeable, vapor-permeable floor covering comprising the steps of adhesively bonding a first surface of a secondary substrate to a first surface of a breathable polymeric film which is liquid-impermeable and vapor-permeable with a hot-melt adhesive, said secondary substrate

comprised of a plurality of bicomponent fibers, each fiber having a core of a high melt polymer and a covering of a low-melt polymer; and

adhesively bonding a second surface of said secondary substrate to a first surface of a primary substrate that has tufts of yarn extending away on a second side of said primary substrate by melting and then refreezing portions of the low-melt polymer of the covering of the bicomponent fibers while these fibers are in contact with said first surface of said primary substrate.

16. A process for producing a liquid-impermeable, vapor-permeable carpet comprising the steps of:

bonding a polymeric film that is liquid-impermeable, vapor-permeable to a secondary substrate, thereby making a first layer of said carpet, said first layer being a composite secondary backing and which when said carpet is installed is the lower layer thereof;

attaching a primary substrate to a plurality of piles of a yarn such that said piles have backstitches on one side of said primary substrate;

and adhering said one side of said primary substrate to said composite secondary backing with a hot-melt adhesive.

17. The process for producing a liquid-impermeable, vapor-permeable carpet as claimed in Claim 16, wherein said secondary substrate is comprised of a plurality of bicomponent fibers, each fiber having a core of a high-melt polymer and a covering of a low-melt polymer;

said process further comprising feeding a supply of said bicomponent fibers and said film to a nip between a heated drum and a roll, the nip having a size of the desired thickness of said secondary substrate, said heated drum having a surface temperature that is higher than the melting point of said low-melt polymer covering, but below the melting point of said high-melt polymer core.

18. The process for producing a liquid-impermeable, vapor-permeable carpet as claimed in Claim 16, wherein said film is bound to said secondary substrate with a hot melt adhesive in a pattern of portions having spacings between said portions.

19. The process for producing a liquid-impermeable, vapor-permeable carpet as claimed in Claim 16 including penetrating and encapsulating at least a portion of a plurality of fiber yarn bundles comprising backstitches on a lower surface of said primary

substrate and bonding said backstitches to said upper surface of said secondary substrate.

20. The process for producing a liquid-impermeable, vapor-permeable carpet as claimed in Claim 16 including using a low viscosity hot melt adhesive.

Fig. 1

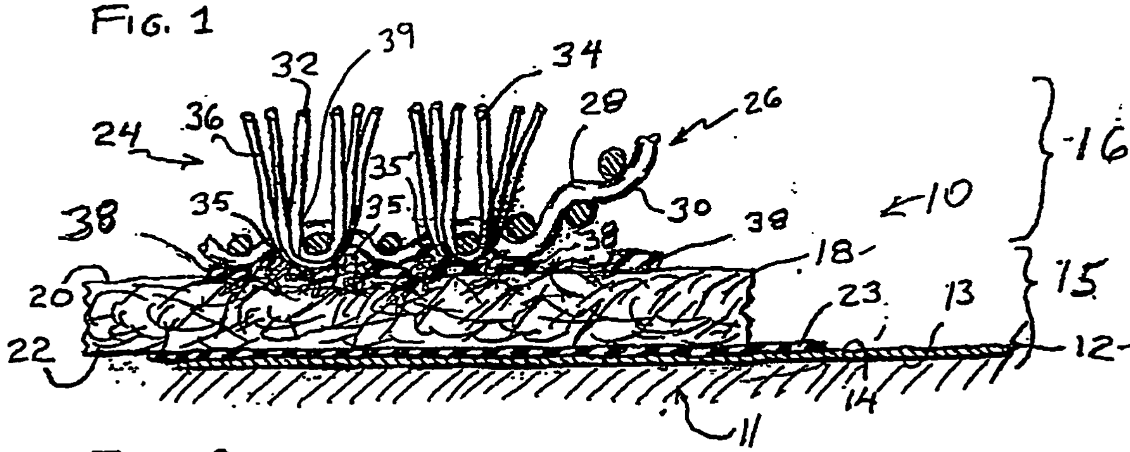

32
39
34
36
24
28
26
16
35
35
35
30
10
38
38
38
18
15
20
23
13
22
12
14
11

Fig. 2

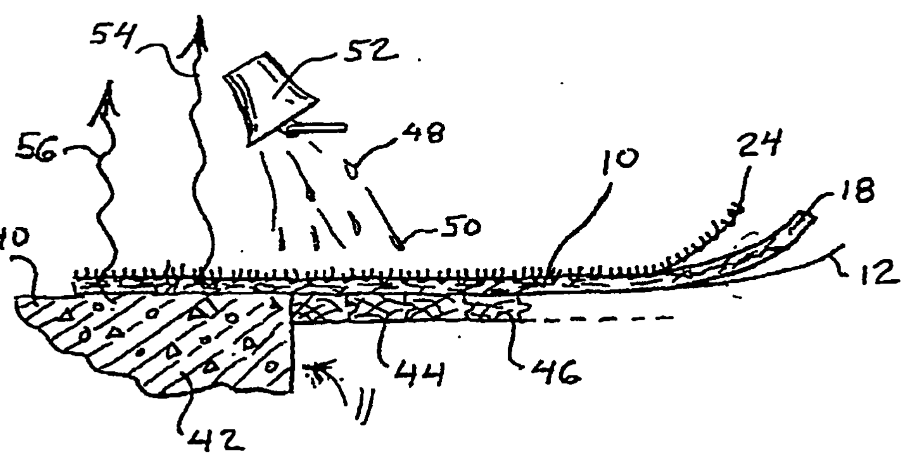

54
52
56
48
24
10
18
50
40
12
44
46
11
42

FIG. 4

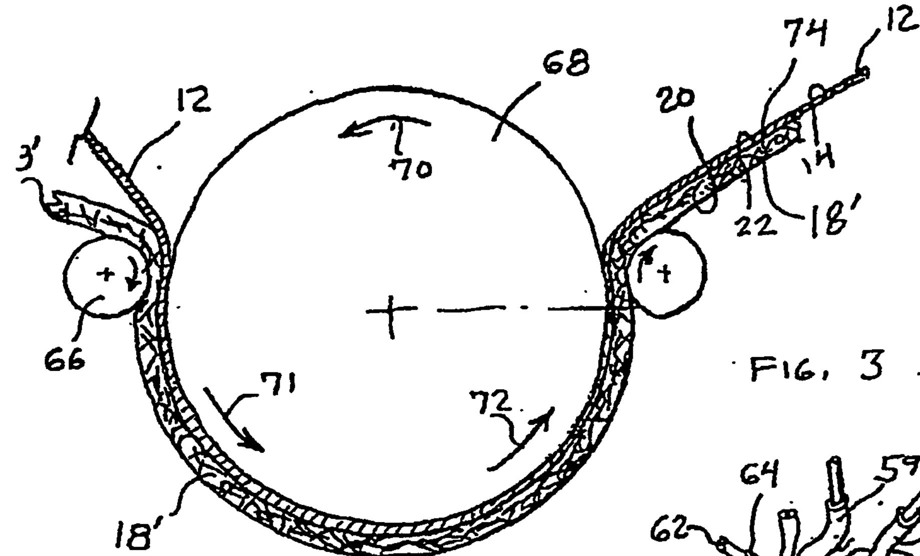


FIG. 3

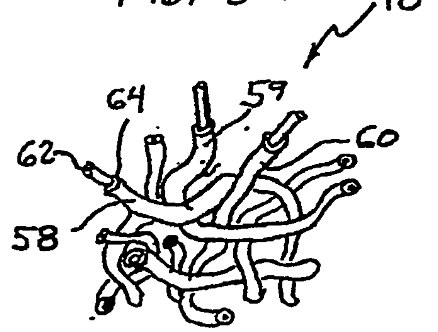


FIG. 5

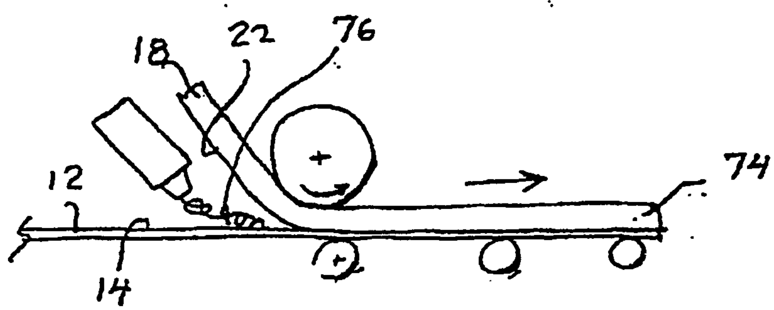


FIG. 6

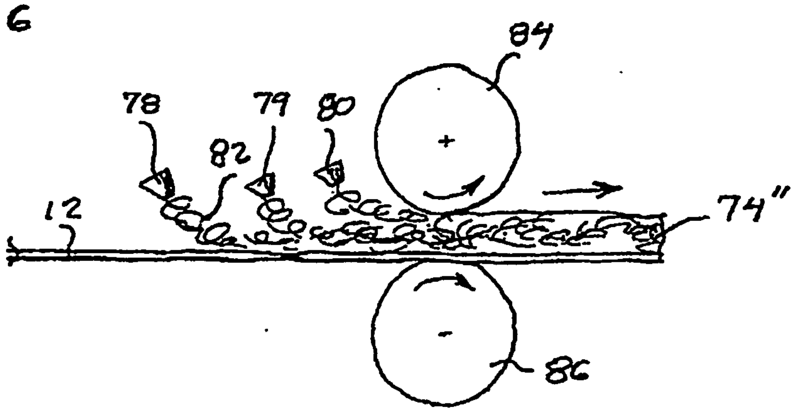


FIG. 7

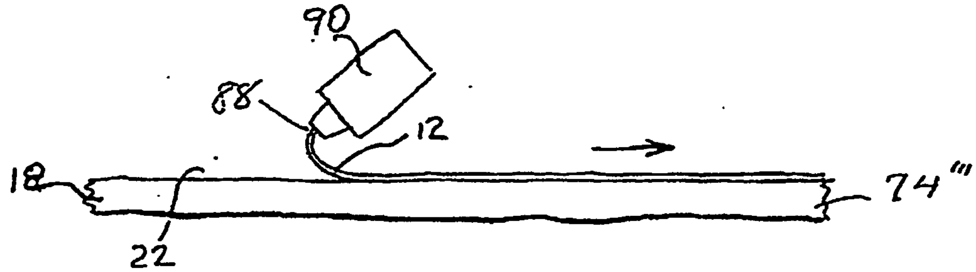


FIG. 8

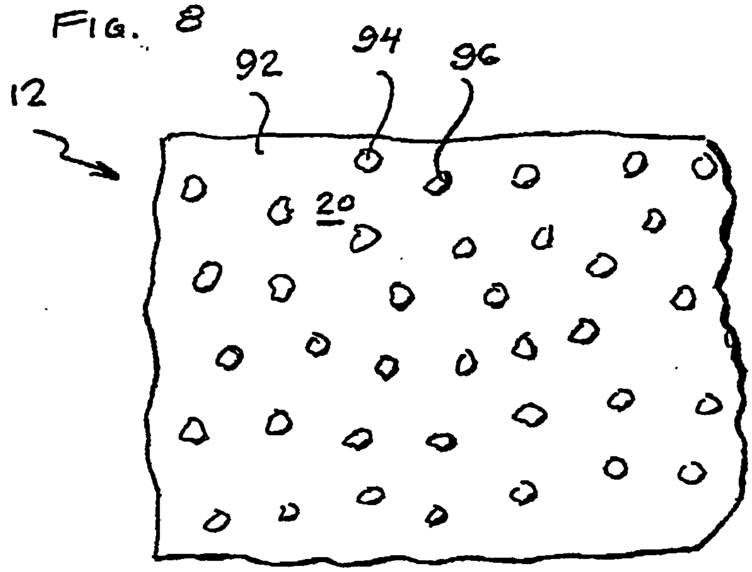
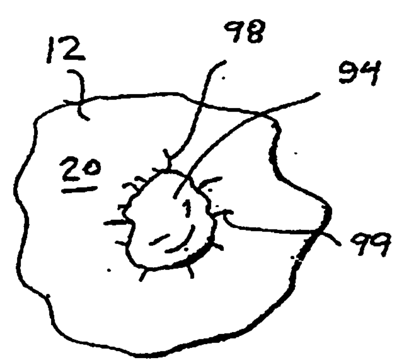


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/20150

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :Please See Extra Sheet.
US CL : 428/95, 96; 156/72, 290, 297, 299, 300, 308.2.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 428/95, 96; 156/72, 290, 297, 299, 300, 308.2.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USPAT, EPO, JPO, and DERWENT.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,578,357 A (FINK) 26 November 1996, col. 1, line 16-col. 2, line 65.	1-7, 9-12, 14, 16, and 18-20N
Y	EP 0,624,681 A2 (E.I. DUPONT DE NEMOURS AND COMPANY) 17 November 1994, see abstract; page 2, lines 20-24; page 3, lines 7-8 and lines 49-58; and page 4, lines 3-8, 27-38, and 43-46.	1-7, 9-12, 14, 16, and 18-20
Y, P	US 6,162,309 A (BRODEUR, JR. et al.) 19 December 2000, see col. 1, lines 34-38 and col. 2, lines 33-37).	1-7, 9-12, 14, 16, and 18-20
Y	US 4,112,161 A (SORRELLS) 05 September 1978, see col. 1, lines 33-42, col. 2, lines 6-10, col. 3, lines 48-58, and col. 4, lines 27-34.	1-7, 9-12, 14, 16, and 18-20

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search	Date of mailing of the international search report
11 AUGUST 2001	28 AUG 2001

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	CHERYL JUSKA
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0661

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,614,281 A (JACKSON et al.) 25 March 1977, see col. 14, lines 37-47.	1-7, 9-12, 14, 16, and 18-20
Y	US 5,945,210 A (SENBA et al.) 31 August 1999, see abstract; col. 1, lines 15-22; col. 4, lines 5-12; and col. 7, lines 16-17.	1-7, 9-12, 14, 16, and 18-20
Y	JP 02-139465 A (UNITIKA LTD.) 29 May 1990, see abstract.	8, 13, 15, and 17
A	US 4,389,435 A (HAAS, JR.) 21 June 1983	1-20
A	US 5,382,462 A (PACIONE) 17 January 1995	1-20
A	US 5,763,039 A (STAUBS) 09 June 1998	1-20
A	US 5,800,898 A (GERRY) 01 September 1998	1-20
A	US 5,902,637 A (CASTELLANO, JR. et al.) 11 May 1999	1-20
A	US 5,902,658 A (WYMAN) 11 May 1999	1-20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/20150

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (7):

D05C 17/02; B32B 7/04, 7/12, 27/12, 27/20, 31/04, 31/06, 31/08, 31/12, 31/20, 31/26.